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SPECIAL REPORT

EXTENDED APPLICATIONS OF MANAGEMENT
INFORMATION SYSTEMS IN GOVERNMENT

by

Ralph L. Normeu

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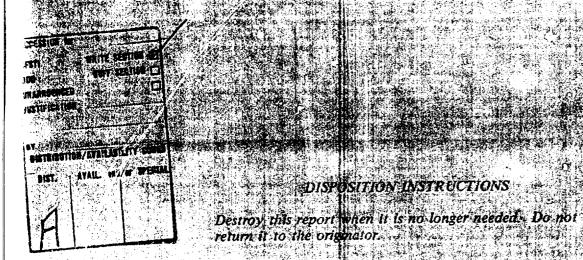
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ABSTRACT

This is a time in our Nation of great social change and unrest. Our government continues to move ahead with reforms, but, at times, these reforms seem slow in bringing about needed improvements. Many of these problems are wholly or partly managerial in nature.

A partial solution to many of these problems would be found in the use of management information systems by the higher levels of government--the Congress and the President.

Consideration is given to more extensive use of modern management approaches and tools, especially systematic approaches using management information systems, to assist public officials and managers in conducting better policy analyses, in determining more overtly the priorities of government, and in evaluating these efforts in a more efficient manner.

A literature evaluation leads to a compilation of the most desirable characteristics of management information systems at higher levels of government.

It is predicted that a management information system will be installed in the Executive Office of the President about 1980. This prediction compares well with apparent Soviet accomplishments in using computers for management purposes.

ii

TABLE OF CONTENTS

PREFACE

"Any organism is held together by the possession of means for the acquisition, use, retention, and transmission of information."

Norbert Wiener
Cybernetics

"The basic problem is the broad deficiency of management sophistication and knowledge which impedes government administration at all levels of management."

Alfred L. Thim
"Ideological Pitfalls in
Contemporary Management
Practices"
Advanced Management
Atlanta: Civil Service
Commission, 1960

"The nation needs better policy analysis. Each area one investigates shows how little is known compared to what is necessary in order to devise adequate policies."

Aaron Wildavsky
"Rescuing Policy Analysis From
PPBS"
Public Administration Review
March/April 1969

"The failure has been us, not the constitution. It's a failure to be committed, not to care. Words are not self-executing. Let's not ask too much of constitutions and words. Let's ask a lot more of ourselves."

Ramsey Clark

v

"In the next 30 years, the U. S. population is expected to grow by 100-million people. Even if . . . 100 new communities averaging 100,000 people and ten new cities averaging one million were to be built, they would accomodate only one-fifth of this population increase. To house them all in new "viable" cities would mean building a city of 250,000--about the size of Tulsa--every month between now and the year 2000."

National Commission on
Urban Growth

". . . the spotlight of public attention and concern is today sharply focused on the issue of priorities in American society, the public is neither well informed nor much concerned about the composition--as opposed to the total size--of the budget of the federal government. This is a singular inconsistency, for the President's annual budget is the vehicle for the most important comprehensive collection of priority decisions which our society makes in the course of a year."

"The reasons for public inattention to the details of the budget are clear enough. The budget is not one document but four, ranging in size up to the 1,100-page budget appendix. It is highly complex, and it abounds with numbers whose meaning is often elusive. Although it reports the results of hard decisions among competing priorities, the budget does not indicate which choices were the most difficult or what plausible alternatives were available."

Charles L. Schultze et al.
Setting National Priorities:
The 1971 Budget. Washington:
The Brookings Institution, 1970

". . . if it is enhancement of thinking that we want, then this will come about in large measure through the extent and depth of the testing experience that each individual has the opportunity to gain. It must be this way. For if it is agreed that the uncertainty in complex problems is large, that there may be more than one right way to structure a problem, that there may be more than one right way to answer a problem, and these answers cannot be known with certainty in advance, and that there may be more than one right path to reach many of the right answers that are possible, then lacking omniscience, there is no alternative omniscience, there is no alternative to developing an

vi

enhanced thinking capability other than through testing and retesting continually the world about us and the systems in it."

> Maurice Rappaport
> The Knowledgeable Analyst:
> An Approach to Structuring
> Man-Machine Systems
> AFOSR 4490, Contract No.
> AF 49 (628)-1020, February
> 1963, p. 76

"   "High on the list of our national priorities courageous political leaders must inscribe--and then inspire--BETTER MANAGEMENT; it is basic to everything else."

> Walter A. Kleinschrod
> "Government Plods Ahead to
> Management Reform"
> Administrative Management
> December 1970

"There is a rare distinction and satisfaction to work for one's country instead of for dollars, to pursue principle in lieu of profit. . . There is much to be said for the 'in-and-out' approach to government service. The man experienced in private pursuits brings that much more to a temporary sojourn in government later in life. The opportunity to serve is never foreclosed by a single decision at any single time. Whether it be now or later. Please remember that the nation has need of the services of those who desire to serve."

> Edward R. Morrow
> John Hopkins University
> June 13, 1961

"God give us men! A time like this demands

    Strong minds, great hearts, true faith

        and ready hands

Men whom the lust of office does not kill;

    Men whom the spoils of office cannot buy;

Men who possess opinions and a will;

    Men who have honor; men who will

        not lie . . .

Tall men, un-crowned, who live above the

    fog

In public duty and in private thinking."

                Josiah Gilbert Holland
                Familiar Quotations

INTRODUCTION

These are extraordinary times in which to assess the condition of our country--extraordinary because so many elements are in absolute conflict with each other. It is easy to look at the United States--its economy, its productive ability, its preeminent position in the world--and conclude that the Nation has never been so healthy or so powerful. It is equally possible to look at another set of factors and to emerge with a picture of social illness, community disorientation, security weakness, psychological distress, and economic disarray so massive as to seriously raise the question whether our society, like Rome in an earlier time, may not already be in a state of advanced decay.

One of the elements that makes this assessment so difficult is the profound effect of technological and social change.

We live in a time of radical change. Some of us--I'm one of them--believe it is a time of revolutionary change, changes so fundamental as to alter the values of virtually everyone. [1]

Our government continues to move ahead toward reforms in many areas, however, few of us need to be told that the pace seems far too slow. Certainly many of our public officials including President Nixon feel change is required and work steadily at bringing about improvements.

Few people with a sincere interest in government will fail to agree that many of the Nation's problems are wholly or partly managerial in nature. Most will further agree that management tools are already available to aid in the solution of many of these problems.

Evidence before Congress[2] paints a graphic picture of the U. S. Government burying itself in mountains of paper. More and more delays are insured by more and more red tape and regulations. This June's hearings by the House Public Works Subcommittee found:

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[1]Cherne, Leo. "The State of the Nation." Perspective in Defense Management. Washington: Industrial College of the Armed Forces, December 1969.

[2]"The Red-Tape Jungle--Spreading, Costing Billions." U. S. News and World Report. July 19, 1971.

● Just to design and contract a ten-million-dollar office building takes government almost five years. Private industry averages two years. The additional time with inflation costs the taxpayer about 35 per cent more.

● Costs of building a highway with federal help are estimated at 30 per cent more than without federal help.

● One "quick reference" form on federal project environmental impact about the size of a small tablecloth contains 8,800 small squares for data.

● An Economic Development Administration grant to help hard-hit areas of unemployment averaged 79 days for processing in 1966 and 346 days in 1970. Time for a small business loan grew from 125 days to 309 days.

Representative Wright (Dem., Taxas) summarized: "These hearings . . . demonstrated that red tape can be a sieve through which escape . . . the benefits intended by a program and much of the taxpayers' hard-earned money . . . It is no wonder . . . more and more people avoid federal programs like the plague." One agency returned a federal aid application for buying interior furnishings for a Hopi Indian school on the grounds it failed to have an acceptable environmental impact statement! Congressman Wright blames Congress for some of the red tape and feels government administrators add further paperwork never envisioned by Congress. [3]

Doctors force the old and poor to pay for Medicaid at the time of the visit, municipal services decline and our court schedules bog under massive case loads as our bureaucracy appears to slowly grind down. These examples and many others share a common symptom of deterioration--deterioration at least partly managerial in nature. [4]

A recent article entitled "Government Plods Ahead to Management Reform,"[5] describes some of the ills of our government and asks the critical question: Is the pace fast enough?

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[3]Ibid.

[4]Kleinschrod, Walter A. "Government Plods Ahead to Management Reform." Parts I and II. Administrative Management. December 1970 and January 1971.

[5]Ibid.

2

Once it was comfortable and comforting to view the world as a mechanism functioning in parameters of discoverable and controllable cause and effect relationships. That image seems no longer valid and the newer world has replaced in it the old stable parameters with variability, uncertainty, and probability.[6] These newer dimensions leave many of us less sure of ourselves. But these newer dimensions of variability, uncertainty, and probability can be just as readily handled by newer management approaches as the older dimensions were handled by the older approaches.[7]

These newer dimensions also seem to say that the image of any organization as a closed system of fixed boundaries, structures, and functions is, for all ordinary purposes, quite dead insofar as its management is concerned. These times commenced in a manner which certainly says that both public and private enterprise must face challenge of survival, consolidation, growth, and change in new ways.[8]

Some of the newer management approaches themselves, such as planning-programming-budgeting system (PPBS), have already made it painfully clear that the agencies of our government are not organized in terms of objectives and purposes within themselves, let alone any sort of systematic framework as a total. Their names imply a role for which Congress gave them no authority or for which they have not assumed the duties. The National Cancer Institute generally does no developmental trials to test the feasibility of detecting various types of cancer; it mainly does cancer research. The Food and Drug Administration functions to protect us from food additives and contaminants but does not examine the adequacy of diets. This type of agency organization and mission assignment allows many problems to go ignored. Congress

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[6]Culvert, Samuel A. and Jerome Reisel. "Organization Development: An Applied Philosophy for Managers of Public Enterprise." Public Administration Review. March/April 1971.

[7]Many fine works of recent origin on applications of systems analysis in or related to government are available. In discussion of management information systems at higher levels of government, it is not possible to do justice to these works. For the interested reader a reference list of twenty-one books has been compiled as Appendix I.

[8]Culvert. op. cit.

and agency representatives discovered in 1966 that little information existed on the extent of malnutrition in our Nation.[9]

Perhaps the quality of government has not deteriorated but has just failed to improve to the extent necessary and in the ways called for by the social change.[10] The problems of managing our Nation effectively appear so pervasive and complex that familiar methods of governmental operations seem most outmoded.[11]

Our Founding Fathers intended to establish not an efficient corporation but a free society under law. And that establishment has worked well. But now we must ask does it work well enough?[12] This question is not asked because some radical reform will be proposed but rather to create a mood which fosters a dilingent search for the means of more acceptable approaches to reform.

One of these more acceptable approaches to reforms at higher levels of government is better management. In particular, better management through the extended use of management information systems.

THE PROBLEM

The problem under consideration here is one of how to use modern management approaches and tools to assist public officials at the higher levels of our government in conducting better policy analyses and determining more overtly the priorities of government and to assist them in conducting and evaluating these efforts in a more efficient manner. It is not averred that newer management approaches applied through a management information system are a cure for all the ills presently seen in our Nation, only that they can help.

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[9]Levin, Arthur L. "Multisecting the Nation's Nondefense Programs." Public Administration Review. March/April 1971.

[10]Ways, Max. "Finding the American Direction." Fortune. October 1970.

[11]Kleinschrod. op. cit.

[12]Ibid.

An attempt will-be made to show that management information systems are ready for application at the highest levels of government and to determine what are some of the characteristics which should govern the design and implementation of these systems. Little direct effort will be expended trying to determine exactly what data, what simulation, etc. should be a part of these systems. There is ample superior talent available with first hand knowledge for this task. Some areas, such as organizational aspects, will be dealt with only obliquely because again superior specialists are best able to guide and predict in these areas.

An Important Problem

Better approaches to policy analysis, priority determination, planning, programming, budgeting, and all the follow-up operations are sorely needed. The introduction mentioned only a small portion of the problems and the multitudes of qualified people writing on the needs to better perform functions at all levels of government. From this small sampling of literature, the need for better ways of spending the taxpayers' money can easily be seen. Further, there exists the distinct conclusion--it must be done.

A Bit of History

The electronic computer was introduced into government about 18 years ago. Studies recently revealed that electronic computers have not affected top management as rapidly as expected by some. This conclusion probably holds true for the government also. However, these studies forecast an acceleration startling the imaginative. [13]

The cost of data storage in internal computer memory has steadily declined until it has become competitive with traditional paper files. Present random access devices, most not even in existence about twelve years ago, make any bit of data in them available in a few thousandths of a second. Processing speeds of computers make most answers within their programmed capability available while you wait. [14]

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[13] Ream, Norman J. "The Computer and Its Impact on Public Organization." Public Administration Review. November/December 1968.

[14] Carter, Wendell E. "Management Information Needs of the Department of Defense." Armed Forces Controller. October 1968.

The coordinated acquisition and use of electronic data processing (EDP) government-wide was enacted by Public Law 89-306 in 1965 (The Brooks Bill). Representative Brooks (Dem., Texas) made a prediction:

> During the next decade, EDP will be applied to additional administrative and accounting operations in government. But these tasks of an administrative and accounting nature do not tax the inherent capabilities of modern EDP systems. The real breakthrough will be using EDP in the decision-making process. (Emphasis Mine).[15]

Congressman Brooks went on to predict EDP use in "an ever-increasing scale to evaluate various alternatives" and in simulation of problems resulting in higher quality decisions with more effective and efficient government. But he warned: "The capabilities of any EDP system will always be limited to the intellectual capabilities of those who design, program, and manage its operation."

This man of foresight did not stop with this challenge to all public officials. He specified the levels of our government for EDP application: "Such a system is desperately needed to provide the essential budgetary, fiscal and other selected data the President and the Congress require for policy-making and for funding purposes."

The management information system still seems preembryonic and perhaps what it really will be is not well defined. However, bit by bit, chore by chore, and little by little, those in the action are developing the answers in hardware, software, and pleased executives. The goal, "the absolute status at any moment", justifies the efforts.[16]

NEW IDEAS

Wildavsky feels there is now a receptivity to new ideas that did not exist a decade ago--a willingness to consider new policies and try

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[15]Brooks, Jack. "The Growing Use of Electronic Data Processing in Government." The Armed Forces Comptroller. April 1966.

[16]Field, Roger. "MIS Comes Percolating Up the Organization." Computer Decisions. March 1971.

6

new ways.[17] If this be true, then hope springs that new management approaches will be applied at ever higher levels of government.

He finds a great need for schools of public policy in which technical training is combined with broader views of the social context of public policy. Students exposed to a range of subjects out of which a creative approach to public policy could come, may prove more creative.[18]

Perhaps similar schools already function although not in exactly the manner Wildavsky visualized. More and more adults in public service are continuing their educations throughout a major portion of their adult lives. This continuing education is often multidisciplinary and functional. Some very fine continuing education programs presently offer graduate work on a part time basis compatible with employees fully employed. The very essence of some of these programs is their provisions exposing the student to a wide range of ideas and varied thinking.[19]

Much credit for this active interest in continuing education can be attributed to the Congress. From 1777 to 1937, 23 educational acts were passed; from 1941 to 1965, 33 educational acts were passed. For the first 160 years Congress enacted educational legislation every seven years; for the next 24 years Congress enacted such legislation almost every seven months. Ten educational acts passed into law from 1950 to 1967.[20]

It may be easily predicted that the general managerial profile of the 1970s will be dominated by computer and communication capabilities.

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[17]Wildavsky, Aaron. "Rescuing Policy Analysis From PPBS." Public Administration Review. March/April 1969.

[18]Ibid.

[19]As an example the University of Oklahoma Advanced Programs which are especially suited to the requirements of public officials and civil service. Some others are Northwestern, Ohio State, University of California at Irvine, University of Alabama at Huntsville, and Pennsylvania State.

[20]Tiedt, Sidney W. The Role of the Federal Government in Education. New York: Oxford University Press, 1966.

7

These electronic advances are inexorably to affect traditional organizational arrangements and institutions--a far greater centralization in decision-making will keep pace with its increasing feasibility.[21] The newer techniques of adult education by our finer institutions although now very useful have just begun their tasks.

CHANGE AND ORGANIZATIONS

It so happens that the world is undergoing a transformation to which no change that has yet occurred can be compared.

Charles de Gaulle

Bennis[22] wrote a book on change and organizations and he seems to have used the word computer only once in his book. But he forecast change and so do many others. The computer has had an unprecedented impact on the conduct of the routine operations of the government.[23] It seems destined to continue this impact throughout the levels of management.

One unique characteristic of the computer is that it forces men to think about what they are doing with clarity and precision. One cannot instruct the computer performance usefully until one fully understands what is to be done and what is sought.[24]

Already within the government there are numerous new organizations that are engaged in the development of government management information systems which employ electronic computers. These efforts should ultimately streamline and reorganize the involved organizations.

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[21]Blomgren, H. E. "Comptrollership Training in the 1980's--Tomorrow's Challenge." Armed Forces Controller. January 1969.

[22]Bennis, Warren G. Changing Organizations. New York: McGraw-Hill Book Company, 1966. p. 11.

[23]Ream. op. cit.

[24]Borch, Gilbert. The Computer Age and Its Potential for Management. New York: Harper & Row, Publishers, Inc. 1965. pp. 2-3.

8

We see the creation of new cabinet-level departments and independent agencies such as the National Aeronautics and Space Administration. Rapid changes occur in the Executive Office of the President. Just how much these changes are brought about by factors such as electronic data systems is not measurable. Yet much evidence could reasonably be presented that reorganization was structured to cope with rapidly changing scientific, social, and economic climates.[25]

Thus far, more than anywhere else, techniques for the managerial use of computers is reflected more in the military. Even here the capacity for complex analysis appears to have only begun. When the realizations of this capability hits industrial and governmental organizations, the same radical innovations, reorganizations, and operational behavior will occur that occurred to the military earlier.[26]

The revolution may be compared to today's use of the telephone. The telephone's superiority over the telegraph in our day-to-day management activities stems from the telephone's availability on our desks such that everyone can use it with ease and efficiency.[27]

For full benefit to senior management, the computer must make the same strides. It must permit interaction without any new language or code, without a typewriter, without much waiting. It must be on the desktop, ready at all times.[28]

The newly emerging structures of government are partially the direct influence of the Congress even now and involve efforts to change the structure and distribution of influence in local governments to further nationally selected goals. Federal subsidies and regulations assemble local functions into larger multicountry units usually such as regional councils of government.[29] At this time these changes in

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[25]Ream. op. cit.

[26]Spiegal, J., J. K. Summers and E. M. Bennett. "AESOP: A General Purpose Approach to Real-Time Direct Access Management Information Systems." Mitre Corporation, AD-634 371, June 1966.

[27]Ibid.

[28]Ibid.

[29]Warren, Robert. "Federal-Local Development Planning: Scale Effects in Representation and Policy Making." Public Administration Review, November/December 1970.

9

organizational scale, structure, and national-local linkages are
directly traceable to attempts by Congress at better policy decisions,
better determination of priorities, and greater economies of scale--
all of which management information systems will greatly aid.

James Webb[30] sees emerging "a type of administrative leader
who has enough know-how and experience in the dos and don'ts of
large-scale organized efforts to understand both the value of these
concepts and the ill-defined limits beyond which society cannot yet
proceed with safety in their use." He further foresees "the early
stages of theoretical and doctrinal advances that citizens can use in
deciding complex issues relative to the constructive use of great
aggregations of resources and power that are today difficult to under-
stand and judge."

One writer feels organizations will be understood by the way
they process information in making decisions. Organizational infor-
mation processing is then defined as the range of relevant informa-
tional elements actually taken into account in decision-making and the
different, but relevant, ways the information is combined into decision-
making perspectives. The effectiveness of management information
systems is then defined in terms of its capacity to process information.[31]

To enhance rapid and effective information transmission,
information systems must function across departmental boundaries
which now tend to limit transmission speed of information. This may
be said also of utilization of the information itself once it crosses the
barrier.[32]

The implementation of management information systems into
higher levels of government will certainly involve change and change
involves giving up something familiar, known, and understood for
something new. The transition from the old to the new management
system will be a change comparable to rebuilding the automobile's

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[30]Webb, Jame E. Space Age Management: The Large-Scale
Approach. New York: McGraw Hill Book Company, 1969. p. LX.

[31]Schroder, H. M. "The Measurement and Development of
Management Information Systems." Princeton University, September 1970.

[32]Lowe, E. A. "Efficient Forecasting and Management Information
Systems." Management Decision. Winter 1970.

10

engine while increasing speed. On top of this is the weight of the powerful human resistance to things new. [33]

DEFINITION OF A MANAGEMENT INFORMATION SYSTEMS

Thus far several terms--computer, electronic computer, management information system, EDP, etc.--have been used without being too careful about the precise meaning of these terms. It is doubted that the reader has suffered any from this laxity. However, it becomes necessary at some point to define more carefully the boundaries of management information systems for purposes of better discussion. In the event the reader does not fully agree with the below definition of management information systems, it is well to keep in mind that if his defined characteristics of the system help management then it would probably be acceptable. The importance of the systems lie in their intended purpose--to better serve management. [34]

The term management information system is defined by the military:

> Management Information System: An organized
> assemblage of resources and procedures required to
> collect, process, and disseminate data for the purpose of
> converting it to meaningful information for decision making
> in executing the command/management functions of planning,
> organizing, directing, coordinating, and controlling the use
> of resources to accomplish missions and tasks. [35]

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[33] Archibald, Russell D. and Richard L. Villoria. "Problems and Pitfalls in Implementing Management Information Systems." American Society of Mechanical Engineers. Winter Meeting, New York, Nov. 29-Dec. 4, 1964.

[34] Holstead, Bruce Brantley. "The Application of Operations Research Techniques to the Evaluation of Military Management Information Systems." Naval Postgraduate School, AD-721 578, March 1968.

[35] Management Information Systems Directorate, Office, Assistant Vice Chief of Staff, Department of the Army, Study of Management Information Systems Support. Volume II, December 1968. p. B-9.

Another definition is:

> . . . define this type of system as an operating set
> of procedures which causes the flow of required informa-
> tion from the proper source, processes the information
> needed and presents it to appropriate managers in
> meaningful form and in a timely fashion, for his evaluation
> and subsequent decision-making. . . [36]

Both of these definitions encompass two major thoughts--
information is presented to management for decision-making. Many
other similar definitions and discussions of management information
systems are found. [37]

DECISION—MAKING

Management has been defined as the process of setting objectives
and goals, developing an organization and an environment conducive to
their achievement, and evaluating and controlling progress toward them.
Organization is not enough; it must be matched to environment. A
simple approach to resource management requires that requirements be
determined and validated, that resources available be applied against
the requirements, and that the utilization of available resources be
evaluated and controlled. [38]

But this approach to management of resources is a bit military
and would probably not satisfy some officials at higher levels of
government.

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[36] Archibald et al. op. cit.

[37] See Edward J. Mahoney. "General Accounting Office Views on
Government Management Information Systems." Armed Forces
Controller. October 1968; Walter J. Kennevan. "Management Informa-
tion Systems: MIS Universe. " Data Management. September 1970;
Roger Field. "MIS Comes Percolating Up the Organization. " Computer
Decisions. March 1971; David Alfred Lewis. "Inception, Design and
Implementation of a Management Information System." American
University, June 1967.

[38] Kessler, H. Eugene. "What Price Strategy. " Military
Review. February 1971.

12

Decision-making at higher levels of government appears well-defined indirectly by Turkevich: "The incorporation of science and technology into society is crucially important to the welfare of the modern state. The military and economic importance of technological developments, their limitless possibilities for good and evil, their inexhaustible demands for funds from the national economy, require immense organization--for gathering significant information, for making policy decisions, for planning, allocating manpower, conducting basic research and assigning priorities to development and production."[39]

Its need in our Nation comes from Draper: "Some countries have tried to hold a position of high influence on the basis of an existing but static superior level of ability. The failures of these attempts are recorded many times in the history of mankind. When, for any reasons, a mighty nation has ceased to travel the path of progress, it has always been passed by rivals who continue to strive for advancement in living conditions, economic activity, and military power."[40]

Decision-making involves less-than-well-defined normative factors and matters of political nature which must be translated into courses of national action. Approached in this manner, decision-making can be willfully done and how much is compelled by forces beyond the control of the decision-maker is not yet determined.

Henning[42] points out that the concept of public interest in policy is abstract and highly subject to value interpretations by administrators and agencies. The administrators may create special environments to make decisions based on their professional images. Yet their values may be limited by education, personality, and experience, and shaped

[39]Turkevich, John. "Soviet Sciences Appraised." Foreign Affairs. April 1966.

[40]Draper, C. Stark. Unpublished paper, May 1965. Quoted in Webb. op. cit.

[41]Etzioni, Amitai. "Mixed Scanning: A 'Third' Approach to Decision Making." Public Administration Review. December 1967.

[42]Henning, Daniel H. "Natural Resources Administration and the Public Interest." Public Administration Review. March/April 1970.

by agency goals. These agency goals are often biased not in the public interest.

This analysis indicates that present formulas are often based on economics and population numbers with little consideration of intangibles and quality. This results in decisions on resources wherein "the greatest good to the greatest number for the longest time may mean few and insignificant benefits for everyone, and an increase in socioeconomic benefits may only mean large profits for small clientele groups . . . " The implementation of simulation in management information systems provides means to expand the alternatives in decision-making.

The lack of knowledge in many areas demonstrates how lit'le is known compared to what is necessary to devise adequate policy. Presently in some organizations there are no ways of determining effectiveness of existing programs. Even determination of the simplest objectives of accomplishment are impossible. Any attempts to bind the organization to any measure of productivity is resisted. [43]

This faulty approach by some agencies puts a high premium on ordered decision-making. Any improvements in identifiable objectives and measurements of achievements is an improvement. Considerations of alternative and future costs are welcomed. [44]

Wildavsky [45] writes considerably on what he defines as policy analysis--a process which complements the agencies' decision-making. This is believed a tool of social change. It aims at providing information that contributes to an agency's political and social relevance. It guides the agency in goals, objectives, and missions. It seeks knowledge and opportunities for dealing with an uncertain future by consideration of alternatives.

This form of analysis is compared to a broadly defined systems analysis. [46] Some definition of the differences in a narrow study and

[43] Wildavsky. "Rescuing Policy Analysis From PPBS." op. cit.

[44] Ibid.

[45] Ibid. For background see Aaron Wildavsky, The Politics of the Budgetary Process. Boston: Little Brown and Company, 1964.

[46] Wildavsky, Aaron. "The Political Economy of Efficiency." Public Administration Review. December 1966.

14

one with wide policy implications are helpful in grasping the quality higher-level decision-making envisioned. In true analysis, correct attention would be given to the political aspects of decision-making. The broadest views would be taken of value aspects and political realities to reach innovative solutions. [47]

The decision-maker, faced with greater and greater complexity and more and more data, must resort to the computer's processing speeds for the required calculations. In decision-making, calculations are important but not sufficient. Enhancement and support of the thinking processes are required and symbol manipulation provides some of this enhancement. Exploitation of management information systems provides possibilities for not only generalized, flexible and rapid collection, retrieval, collation, and correlation of information but advanced symbol manipulation as well. [48]

Management information systems will begin to be used almost immediately on an ever-increasing scale to evaluate alternatives. They will be designed and programmed to simulate closely the problems of our government and will result in higher quality decision-making. The coordination in data will save millions of dollars of tax funds and the system will provide the essential budgetary, fiscal, and other selected data required by the President and the Congress. The sum result will be more effective and efficient government. [49] The real opportunity for computer use in decision-making lies in the area of complex decisions involving many factors and many interfaces, all with risks and uncertainty. [50]

[47]Dror, Yehezkel. "Policy Analysts: A New Professional Rose in Government Service." Public Administration Review. September 1967.

[48]Dion, Frederic A. "A User-Oriented Information Processing System." Rome Air Development Center, AD-604 277, June 1964.

[49]Brooks. op. cit.

[50]Rowe, A. J. "Management Information Systems: Objectives, Opportunities and Requirements." Management Information Systems and the Computer. Robert Drew, ed. Brussels: Management Centre Europe, 1969.

PPBS

The search for better ways to do things in government is not new; however, from the standpoint of management information systems, one recent attempt to do decision-making better--planning-programming-budgeting systems--is worth analysis.

In 1965 when President Johnson issued the order introducing planning-programming-budgeting systems (PPBS) into government agencies, it was greeted by some as a breakthrough in the decision-making process. It was said to provide a rational basis on which to allocate resources among the many demanding programs.[51]

The budget generally had done a poor job in revealing the objectives of government programs. This is partly because it is organized along the lines of agency organizational units. A hope of PPBS was that it would help planners to better see the objectives of hundreds of federal agencies in a manner to better decide the allocation of resources.[52]

The basic principle of PPBS is that decision-making on complex objectives can be accomplished in terms of outputs rather than inputs.[53]

At the time McNamara became Secretary of Defense, the armed forces determined their needs by the requirements method. A military need, somehow determined, was studied and a plan drafted to solve the problem. The resources needed for the plan were determined and compared with the currently available resources. Any shortcomings in currently available resources became a requirement. Certain feasibility studies were completed and the total results submitted with a usually padded funding request.[54]

The controller for McNamara, Hitch, revamped the method for determination of requirements. The new method was a systematic economic analysis and the real basis of PPBS. With this systematic

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[51]Botner, Stanley E. "Four Years of PPBS: An Appraisal." Public Administration Review. July/August 1970.

[52]Levin. op. cit.

[53]Kessler. op. cit.

[54]Ibid.

16

approach, the objective is framed as clearly and concisely as possible. The framing requires identification of all alternative approaches and required resources for each alternative. The continued analysis attempts selection of, if not the best, at least, a better alternative. This approach has the advantage of ordering analysis before the approval of the expenditure of available resources. [55]

PPBS PROGRESS

Attempts have been made to measure the progress of PPBS since its implementation in 1965. The results indicate that the agencies and especially the Office of Management and Budget are still struggling to comply with the President's order. [56]

An intensive study of 16 federal agencies led to the conclusion that most agencies still perform their PPBS functions very much as they did before the order. [57] Further reviews of critical factors lead to the conclusisn that PPBS has been rather ineffectual as a presidential staff tool. [58]

Every division in HEW with health-related programs was asked for purpose statements for the programs. These statements were to contain complete goals and objectives reflecting all the concerns of the programs. These statements were to systematically relate the programs. [59]

For most HEW managers, this was demanding. Few of the managers thought in any sort of end results and, further, viewed their

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[55] Hitch, Charles J. and Roland N. McKean. The Economics of Defense in the Nuclear Age. Cambridge: Harvard University Press, 1967.

[56] Botner. op. cit.

[57] Ibid.

[58] Harper, Edwin L., Fred A. Kramer and Andrew M. Rouse. "Implementation and Jse of PPB in Sixteen Federal Agencies." Public Administration Review. November/December 1969.

[59] Levin. op. cit.

programs as independent, not some way structured to the other programs. Little thought had been given to alternative approaches, after all, no defined end result requires no alternative possibility to get there. [60]

Only the immediately visible was examined in some cases. In hospital construction, managers knew a significant amount on physical factors (number of beds, size, etc.) but essentially nothing of the impact on health in the locale. [61]

HEW Secretary Gorham, writing on the lack of data on federal program effectiveness, found that an excellent job continued on measuring program resource inputs, but a very poor job ensued with attempted PPBS on end results. Few end results existed. [62] One official commented on evaluation that some agencies spend money but HEW just sends it. [63]

The studies of HEW leave one message clear. A plan for allocation of resources among social problems is urgently needed. [64]

In "Rescuing Policy Analysis From PPBS," [65] PPBS is viewed as a manifestation of policy analysis--the sustained application of intelligence and knowledge to social problems. Wildavsky concludes in this paper "that those who introduced the PPB system into the federal government . . . did not undertake a policy analysis on how to introduce policy analysis into the federal government."

The Department of Defense analysis experience in PPBS revealed the extension into other areas of government as a bad model for several reasons. DOD possessed certain critical elements not present in other agencies:

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[60] Ibid.

[61] Ibid.

[62] Ibid.

[63] Gorham, William. "Allocating Federal Resources Among Competing Social Needs." HEW Indicators. August 1966.

[64] Levin. op. cit.

[65] Wildavsky. op. cit.

18

A group of experienced talented analysts and planners existed.

Common terminology prevailed.

Past experience in long-term planning by top leadership existed.

Goals were easily specified.

A margin of error was tolerable.

Total expenditures make analysis expenditures worthwhile.

Large weapon systems cost billions; therefore, it is easy to spend millions on analyses. When the cost provides protection against the worst, lack of knowledge and margins of error still affect the extremes little.[66]

Several dificulties have been cited in implementing PPBS:

The data base is inadequate.[67]

Federal programs are multipurpose in nature.

Analysts have training and orientation with specific assumptions, methodology, and language.[68,69]

Program evaluation has tended to be another decision-making channel rather than a base for decision-making.

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[66]Ibid.

[67]General Accounting Office. "Survey of Progress in Implementing the Planning-Programming-Budgeting System in Executive Agencies." Report to Congress by the Comptroller General of the U. S. July 29, 1969.

[68]Wildavsky. "Rescuing Policy Analysis from PPBS." op. cit.

[69]Hughes, Phillips S. "Program Evaluation--What's in It for You?" Seminar on Long Range Forecasting. San Francisco, May 29, 1969.

Pressures of office cause long-range consideration to be less considered. [70]

Scarcity of trained personnel on secondary returns exists. [71, 72]

Agencies fail to apply methods to older programs.

Agencies have no standard discount rates.

No inter-agency structure exists. [73]

The system fails to get agency support. [74, 75]

The system requires elements linked to one another and to operational indicators so that effectiveness of alternatives may be systematically compared. [76]

In a careful analysis of PPBS, Anthony[77] concluded that with full top management support, good technical design, an adequate analytical staff, and proper education, PPBS will still be ineffective unless it is tied to a system which provides exact information on spending on each program. Further, he feels the accounting data must identify the spending with the persons having the spending responsibility so control action can be effective.

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[70]Ibid.

[71]Ibid.

[72]Wildavsky. "Rescuing Policy Analysis from PPBS." op. cit.

[73]Joint Economic Committee. "The Planning-Programming-Budgeting System: Progress and Potentials." Subcommittee on Economy in Government, U. S. Congress, First Session 1967.

[74]Botner. op. cit.

[75]Wildavsky. "Rescuing Policy Analysis From PPBS." op. cit.

[76]Ibid.

[77]Anthony, Robert. "Closing the Loop Between Planning and Performance." Public Administration Review. May/June 1971.

Anthony feels the essential characteristics of this required accounting system are:

It must provide for a clean separation between investment costs and operating cos⁺s.

It must measure operating costs in terms of expenses.

It must separate expenses from changes in working capital.

It must establish a close correspondence between program elements and responsibility centers.

Within each responsibility center, expenses must be broken down into categories that are useful to operating managers.

The factor deemed most important in the implementation of PPBS is support of the approach from the upper levels of management. Their viewpoint of and use of the system reflects down the chain extensively.[78, 79]

Why has PPBS failed to promote the quality of decision-making expected? One answer is that PPBS was introduced too early, on too large a scale, too abruptly, and without the proper advance study, preparation, and understanding required. The introduction of PPBS to the cabinet has been described by Commerce Secretary Conner as:

The Cabinet members were called together early one morning without any prior preparation and, after a brief summary by Budget Director Schultze, ordered to put into effect promptly. There was no meaningful discussion of whether or not it would be applicable throughout the Federal Government, even if successfully applied in Defense.[80]

The President had been advised earlier to limit the new system to a few agencies with demonstrated limited competence in program

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[78]Ibid.

[79]Haynes, et al. op. cit.

[80]Bo.ner. op. cit.

planning.[81] Perhaps a period of analysis and refinement in some limited manner would have increased success.[82]

A requirement for more timely, comprehensive, and systematic information has caused the Office of Management and Budget to create the Management Information Systems Staff with objectives of automating the budget preparation process to a further extent and the development of an improved information system to improve the PPBS processes.[83]

Identification of national goals will probably always remain a problem. Mayo has stated the present dilemma:

> . . . we are limited. . . by our inability to develop output measures that permit inter-category comparisons of benefits. For better or for worse, we have no generally agreed-upon way of deciding quantitatively whether the Nation benefits more by providing greater dignity for the aged (and less financial burden on their families) or by training disadvantaged persons in their early 20's or by making our airways safer or by reducing crime.[84]

MANAGEMENT INFORMATION SYSTEMS AND THE SYSTEMS APPROACHES[85]

In the 1971 budget, President Nixon states among other goals:

> A recognition of the importance of the interests of the individual in the decisions that determine his destiny.

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[81]Gross, Bertram M. "The New Systems Budgeting." Public Administration Review. March/April, 1969.

[82]Botner. op. cit.

[83]Ibid.

[84]Mayo, Robert P. "Economic Analysis and the Federal Budget." Statement to Joint Economic Committee, U. S. Congress, September 25, 1970.

[85]No attempt is made to technically cover the many aspects of the systems approach. It is a most useful but complex concept. The interested reader is invited to Appendix I for a listing of books on the systems approach in government.

22

An emphasis on restructuring basic program systems to ensure that government efforts deliver the full measure of their promise.

The budget document adds to this:

Foster basic reforms in government programs and processes by making entire program systems operate more effectively, and by encouraging responsible decentralization of decision-making. [86]

In fiscal year 1971 and the years to come the President and his successors will need the best management tools and approaches available to assist them in achieving these goals.

In Space Age Management: The Large-Scale Approach, Webb says:

The problem of management effectiveness begins, and is most acute, in the higher echelons. The executive charged with the leadership and the conduct of a large-scale endeavor has far-ranging responsibilities. He is the main point of impact in the relationships between the endeavor and its environment. In a very real sense, he has to represent within the endeavor the outside environmental factors--the federal government, the President, and the administration in all its facets, the Congress, and the national public; he has to make sure that the endeavors, goals, and activities are responsive to the requirements and desires of the environment under conditions of rapid change and uncertainty. [87]

Dror feels:

Systems analysis is one of the most useful innovations in modern management sciences and, indeed, in applied science as a whole. Building on earlier work in operations research and systems engineering and based on economic

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[86] Executive Office of the President/Bureau of the Budget. The Budget in Brief — Fiscal Year 1971. Washington: Government Printing Office. 1970.

[87] Webb. op. cit.

and decision theory, systems analysis provides a
prescriptive science methodology that permits applica-
tion of structured rationality to some "problems of choice."[88]

Recent systems approaches to decision-making essentially began
during World War II when mathematical techniques were found to be use-
ful for solving problems of military logistics, such as determining an
optimum search pattern for destroyers in hunting down enemy submarines.
These same techniques have been refined and applied to problem solving
in businesses and government. The approaches now form an advanced
management science and can be called systems analysis toward decision-
making where the computer is essential for adequate application of these
management techniques.[89]

This approach covers the entire area under the manager and not
some special region. The inquiry penetrates the limits and examines
the effects of policies outside the area of activity. This often provides
the basis for requiring correct information before decision-making.[90]

The basis of PPBS and systems analysis have a great deal in
common. The objective of PPBS to achieve an allocation of resources
which most effectively advances the mix of governmental objectives
requires systems approaches to effectively test the allocations. The
systems analysis employs simulation for interprogram comparisons
of the change in benefits resulting from resource shifts.[91]

Simulation techniques via computer models make assessments of
variation even in complex situations vastly easier. They answer the
general question: What would result if . . .?[92]

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[88]Dror. op. cit.

[89]Ferber, Robert and P. J. Verdorn. Research Methods in
Economics and Business. Toronto: Collier-Macmillian Canada, Ltd.,
1970. pp. 178-179.

[90]Ackoff, Russell L. and Patrick Pivett. A Manager's Guide to
Operations Research. New York: John Wiley & Sons, 1967. p. 10.

[91]See Appendix I generally.

[92]Wilkins, Leslie T. "Computer Impact on Public Decision
Making." Public Administration Review. November/December
1968.

24

With the use of simulation models for exercising the system as a means of testing various hypothetical solutions to problems before tests in the social structures must go real-time response to the management information system. Simulation will be one of the most useful items in the management information system.[93]

The orientation or outlook outranks most other factors in systems approaches. The root idea is one so often accepted in principle by most managers but not well followed in practice. The idea is that any solution of any part of the problem has some effect on the activity of every other part of the problem and the total organization. Every part of the system is connected to every other part of the system. To evaluate any decision or action in an organization, it is necessary to identify all the significant interactions and to evaluate their combined impact on the overall organization.[94]

It is the identification of the interactions (interfaces) which next permits segments of the decision to be made at lower levels or carried out at lower levels.

Study shows that systems approaches to analysis have already been employed to advantage in management information systems. Systems approaches provide a natural framework for the analysis and specification of management decision-making and control processes in information systems design. The existence of comprehensive data banks within many agencies provides the application opportunity for systems analysis to the data processing, normative analysis, decision-making, and control functions of large organizations.[95]

Wilkins[96] points out an oblique advantage of more information and the computer: questions concerning the manner of information use in decision-making will be simulated. No longer can the public

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[93]Mahoney. op. cit.

[94]Ackoff et al. op. cit.

[95]Kriebel, Charles H. "Operations Research in the Design of Management Information Systems." Paper presented at the Operations Research Symposium, Technical Association of the Pulp and Paper Industry, Philadelphia, Pennsylvania, March 28-30, 1966.

[96]Wilkins. op. cit.

25

official ignore this avenue for aid in decision-making. The computer represents a threat to the inefficient administrator.

As before stated, the largest group of talented experts in systems analysis exists within the Department of Defense or its contractors. This lack of similar talent for other federal agencies has impeded a systems approach in those agencies. However, the facts are not all dismal--some agencies have top managers who can understand systematic policy analysis and desire it. This is sure to create more knowledge applications in social areas.[97]

The recent decreases in defense spending may improve the availability of systems-oriented analysts for nondefense efforts; however, no studies are known which show this. Many of these people may require considerable retraining and some minor government efforts have begun along these lines. Domestic programming takes place where there is less autonomy from the environment and more first-hand knowledge by experience which contrasts sharply with DOD-type efforts.[98]

Systems analysis gives us an approach to achieve objectives or ultimate ends. It is completely neutral, just like the computer itself, as to what those ends are. It just helps achieve them by more efficient means.

It has been stated that "no one knows how to do program budgeting". Put another way--many know what programming should be like in general, but no one knows what it is like in particular.[99] Systems analysis holds the promise of greatly improving this lack of knowledge.

THE DATA BASE FOR HIGHER LEVEL MANAGEMENT INFORMATION SYSTEMS

In his message to Congress in 1966, on the occasion of the creation of the Department of Transportation, President Johnson said:

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[97]Wildavsky. "Rescuing Policy Analysis From PPBS." op. cit.

[98]"Federal Aid Program Offers Few Joos." Aviation Week and Space Technology. June 7, 1971.

[99]Wildavsky. "Rescuing Policy Analysis From PPBS." op. cit.

> We must acquire the reliable information we need for
> intelligent decisions.
>
> We must clear away the institutional and political
> barriers which impede adaptation and change.[100]

A valid question to ask before concluding that management information systems can be applied at the higher levels of government is: Does the data base exist for the system?

The answer is both yes and no. The no is partly because it cannot be determined completely in advance just what will be required in a management information system designed for the President and the Congress. However, as noted earlier, attempts at limited management information systems are already underway in the Executive Office of the President in the Office of Management and Budget. The answer is certainly yes in the top levels of the military.[101] The military not only has the data base and many systems in operation, although some of them are highly specialized; they are already studying the application of systems approaches toward the evaluation of military management systems.[102]

Management information systems really begin at the bottom and advance upward like a pyramid toward top management. At the bottom, raw data begins its climb to information.[103]

Information comprises a concept which cannot be separated from human mentality and a concept so pervasive in our environment as to make it extremely difficult to be objective about its characteristics.[104]

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[100]President's Message to Congress on the Department of Transportation and for Other Purposes (H. R. 13200), April, 1966, "Creating a Department of Transportation." Washington: Government Printing Office. 1966.

[101]See Appendix II for a sampling of military management information systems.

[102]Halstead. op. cit.

[103]Field. op. cit.

[104]Davies, W. M. "The Company Information System-- Justification and Complexity." Management Information Systems and the Computer. Robert Drew, ed. Brussels: Management Centre Europe, 1969.

27

Mainly the total idea that management information systems have value for management hinges on the premise that computers are information processors. Certainly computers are data processors.[105]

Data has been defined as the facts or inputs to the system which are collected and stored. Information then is the system's outputs which result from the conversion of data into a product which allows management to act on it or not act on it according to an appropriate frame of reference.[106] The purpose of a data base is to hold accumulated data of some undertaking so that the data will be available to produce any information that may be required.[107]

One of the questions to ask when considering a data base is what is its intended use? The proposed use of a data base holds the clue often as to how to best store the data of some undertaking so that the data will be available in the form to produce the information that may be required.

Public Law 89-306[108] (the Brooks bill) provided for the development of a government-wide data system. The National Bureau of Standards shortly thereafter began to work with manufacturers in achieving compatibility of language, software, and hardware. The General Accounting Office began working on the problem within the government to achieve reasonable compatibility for EDP. This goal of compatibility allows all agencies free access to data without requiring duplication of any aspect of data from gathering to information.

The General Accounting Office in a 1968 study recommended strong planning efforts to develop system concepts and to prepare for the establishment of system standards in the form of standard data elements, standard recording methods, standards for converting

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[105] Ibid.

[106] Kriebel. op. cit.

[107] Thompson, T. R. "Structuring Data Bases For Routine Data Processing and the Provision of Management Information." Management Information Systems and the Computer. Robert Drew, ed. Brussels: Management Centre Europe, 1969.

[108] Brooks. op. cit.

28

between subsystem elements, standards for processing, etc. This recommended standardization paves the way for integrated, complex management information systems.[109]

The Army is an example of Armed Forces action. In Army standardization of management information systems and automatic processing, a variety of codes and names represent meanings and uses which are identical. A number of actions have begun the elimination of this inconsistency which will facilitate development and operation of Army-wide standard systems. Considerable progress has been made in several areas of standardization Army-wide and these are believed significant in contribution toward establishing Army management information systems.[110]

We are all familiar with the vast amounts of data collected by our city, state, and federal governments. This data abounds from sources such as the Internal Revenue Service, the Federal Bureau of Investigation, the Armed Services, your local courthouse, etc. Data likewise is collected almost beyond description by business and industry and by the government on business and industry. Institutions, never to be left out of this arena, collect data from everywhere!

Management information systems have been studied and details perfected for small applications in institutions,[111] it has been developed in general,[112] it has been developed for local government,[113] it has

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[109]Mahoney. op. cit.

[110]Schrader, H. C. "Information Systems Management." Armed Forces Controller. October 1968.

[111]Bowman, Patrick Awalt. "A Generalized Management Information System for Computer Facilities at Educational Institutions." Monterey: Naval Postgraduate School, 1971.

[112]Lewis, David Alfred. "Inception, Design and Implementation of a Management Information System." Washington: American University, 1967.

[113]Carney, William B. "The Management Information System: A Tool for Control in Local Government." An unpublished paper. January 7, 1971.

been used by industry,[114] and it has been studied by the Government
Accounting Office[115] and praised by Dror.[116] These are, of course,
just a few scattered examples of the many available, but they are given
to help indicate that the data base must be acceptable or at the least
highly workable.

PLANNING AND DESIGN OF
MANAGEMENT INFORMATION SYSTEMS

The intentions remain not to attempt to cover all the details in
dealing with the planning and design of management information systems
because this is a vast task requiring the services of many specialists.
Some points are covered in particular because the literature lends
support that these aspects of planning and design are especially related
and important to the considerations of management information systems
at higher levels of government.

Until this time, management information systems have been
treated in a manner to indicate that a computer was always involved,
that the system was never other than some form of automation. This
has not been the case always for there have been many manual ways
of performing management information functions which were operated
from files, cards, books, etc. When one thinks of modern management
information systems as extensions of these simpler approaches for less
complex business into organization of greater complexity, the idea is
easier to grasp and loses much of its mystery. Further, this is a valid
viewpoint. The earlier, simpler methods certainly began at the bottom
of the organization, usually as bookkeeping chores and progressed
upwards.

When one speaks of a management information system for the
higher levels of government including the President and Congress, it
is not normally meant that the President or a Congressman would

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[114]Hatton, R. H. "The Development of the Singer Management
Information System — Europe." Management Information Systems and
the Computer. Brussels: Management Centre Europe, 1969.

[115]Mahoney. op. cit.

[116]Dror. op. cit.

30

himself interface directly with the system. However, the interfacing may be done by a group of aides very close to the official.

Usually extensive responsibility to oversee the system, interface with the human operators, etc. is assigned to one or more systems directors whose responsibility it is to see that the system functions to the standards required by the using managers. His knowledge extends well into areas of the system including programming, computer and display hardware, systems management and analysis, and all involved software. He insures that the management information system accomplishes its prime function by bringing to bear its maximum capability through augmentation of the intellectual capability of the user.[117]

Planning a modern management information system for higher levels of government becomes, when examined in detail, a formidable undertaking for the stakes are high and the responsibilities great. To make full use of the technology and serve well, management information systems require strong planning to develop systems concepts and to prepare for the establishment of systems standards. Systems broad enough to provide for the development of basic criteria for the establishment of an integrated system, while at the same time providing for gradual implementation over a time-phased period, are required.[118]

At the beginning, management's needs must be determined before any further planning may begin. A knowledge of the operational environment with internal operations specified must be acquired. All users and their individual needs must be specified. Some system of measuring progress through evaluation of operations is a must. These things and many more must be centrally planned to integrate the system from the beginning thereby avoiding costly fragmentation.[119]

Most of the time the official who must work very closely with the manager or public official will be skilled in many things but usually not in computer operation. He will find himself working closely with people who are highly skilled in computer systems but, perhaps not in decision-making. To avoid many difficulties, but especially to maintain the faith of the official and his organization, the system must be easy to operate

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[117]Dion. op. cit.

[118]Mahoney. op. cit.

[119]Ibid.

so that a rapid understanding of its functions may be conveyed to one not highly skilled in computers.[120]

When ease of operation is discussed, it is well to look into the future, the very near future, a little to examine a device which will indeed put the management information system on top of the desk just like the telephone is today. This new system's real basis will be unique programming of instructions allowing the system to display its information on a desk-top cathode ray tube similar to a small TV set. And the real amazing thing here, it can converse with the user by his lightgun pointer. This gadget will promote its use with ease and naturalness. Even other members of the organization may examine the same problem jointly from different office locations.[121]

The management information systems of the future need to have planned into them the following major characteristics to insure their widest use and highest value:

> A basic internal data management facility that can be adapted and suited to the kinds of computers used in the link-up, the kind of performance which will be expected of the system, and the kind of ability to process the volume of data expected of the system. This is to say there is to be an internal strategy in the basic link-up.

> A variety of families of languages adapted and suited to the prospective users. Each family would be suited to the different levels of sophistication of the prospective users. An overall pattern would fit the strategy of the basic link-up.[122]

The management information system for higher levels of government seems best characterized as being as completely as possible user-oriented. The system can be interrupted at any time by the user to introduce additional instructions or to stop any operations in progress.

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[120]Chapman, Charles D. "Real-Time Processing and Management Information Systems." Monterey: Naval Postgraduate School, 1965.

[121]Spiegel. op. cit.

[122]Goslin. op. cit.

Further, the system must be viewed as a tool to assist the manager and his organization to use all his experience and knowledge to make better decisions. Its every feature is selected to assist the user within the constraints of budget and the state-of-the-art of the technology. [123]

Exclusive of the concepts of hardware, software, keypunching, etc., five major divisions of data base, simulation, forecasting, reports and managerial decision rules and options can be identified in a management information system. [124]

Simulation, also discussed earlier, allows the placing of inputs into known data and best available models for predictions of results. In some aspects, forecasting and simulation are the same except that forecasting is always future whereas simulation may test the effects of some other options which could have been used in past decisions. Forecasting requires inputs of the best data available into the best models available to obtain useful predictions of results. Simulation allows inputs of all options available to aid in the selection of the most desirable option.

Managerial decision rules and options would be more complex as the level of use in the government rises. In definition in part, they would embody all the legal, economic, normative, etc. paramaters applicable to the problem under consideration.

Gosden and Raichelson feel a management information system must be general in purpose, highly flexible, and capable of adapting to new needs. It must be able to interface with three major aspects of the computer world: many diverse kinds of users, many diverse levels of users, and many diverse kinds of data. [125]

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[123]Dion. op. cit.

[124]Bowman. op. cit.

[125]Gosden, John A. and Eugene Raichelson. "The New Role of Management Information Systems." The Mitre Corporation. AD-691 834, April 1969.

IMPLEMENTATIONS

One of the most crucial periods of any new management system occurs at the time of its implementation. This time finds everyone not only called upon to perform their usual tasks but further engaged in implementating something new with all its pressures of change. This period is especially important with complex systems such as management information systems. They usually come about as additions to older, partial systems and the period of change is much longer if a new way to do things were instituted over a shorter period of time. In addition, new ways to do things becomes overlaid with just what new things should be expected and what new things can be done.

Among the changes encountered with a management information system will be the recognition or forced recognition that many judgments previously were made without adequate information. This discovery not only takes time to realize and change the methods of decision-making; it may go badly for much of what was formerly considered valid approaches for decision-making may come under serious questioning. [126]

Many of the personnel connected with a new system will view it during the stressful period of change as if it were in opposition to them. [127] The new equipment, new operating procedures, and the new personnel talents introduced by further education and/or individuals may require extra care in personnel management until the crisis subsides.

Amid the many changes encountered with the implementation of a new management information system, the equipment itself usually presents problems of considerable magnitude. [128] Not only must the equipment be mastered as to operation, its capabilities must be fully determined, and its malfunctions discovered and corrected.

In implementation of a management information system, it is most desirable to keep the conflict and change to a minimum in all ways. Tried and proven software/hardware, full application of methods and knowledge already successfully used in similar applications and

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[126] Archibald et al. op. cit.

[127] Ibid.

[128] Ibid.

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application to basic uses initially will greatly aid in reducing conflict, change, and time required for implementation of the new system.[129]

The fundamental causes of difficulties which prevent effective application of management information systems are the effects of change and technological system deficiencies. The methods for minimizing these difficulties and promoting rapid, effective system implementation include: the adequate definition of system objectives, the placing of responsibility for system operation in the hands of those most directly affected by its success, the use of systematic task-force approach, and continual education of all associated personnel.[130]

TESTING AND EVALUATING
MANAGEMENT INFORMATION SYSTEMS

Following the implementation of any new complex system, it is necessary to perform considerable testing and evaluating until the system functions correctly. Once the system functions according to acceptable standards, it becomes necessary to institute procedures to maintain the system at this level of operation and improve and update the system as required. The improving and updating again require testing and evaluating and the cycle continues as long as the system is viable.

To detail the tests and the evaluation required for any large computer system requires an intimate knowledge of its functioning components as well as its objectives. The component end in any system is certainly best left to those specialists furnished by the manufacturer and those specialists having extensive experience with the applications involved. However, some points can be made concerning the testing and evaluating of systems with the objective of management information systems.

As stated, test and evaluation begin as soon as the new system is in operation and is a never-ending effort to take advantage of any new developments as they occur. In the field of information, this is even far more true than in more routine operations for the routine operations are dependent on the information and decision-making operations. The

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[129] Hatton. op. cit.

[130] Archibald et al. op. cit.

personnel themselves will produce many of the new ideas for extending and modifying the system and in a management information system it is doubly important that these ideas be evaluated for these are the prime people in the organization. [131]

Halstead[132] feels little progress has been made toward the establishment of scientific procedures for the evaluation of complex computer-based systems and has produced a plan to assist in this via a methodology yielding quantitative results. The methodology evaluates each characteristic of the system in comparison to a standard characteristic as defined for a well designed system. A value is assigned based on the comparison. Approaches of this nature will find more application in the future than now, however, it is felt that only astute managers can determine if the system produces the aid required for better decision-making.

Schroder[133] takes an approach to evaluation saying that organizations are understood in terms of the way they process information in making decisions. Definition then proceeds that "organizational information processing refers to the range of relevant information elements actually taken into account in making decisions, and to the number of different, but relevant, ways this information is combined or conceptualized into various perspectives in making decisions."

This approach seems to depend almost totally on a measurement of the information processing capability of the equipment. However, it seems to fail to take into account that information processing capability in management information systems requires the interaction of the human manager counterpart.

The most important evaluation of a management information system consists of the determination of its performance of its basic objective: does it provide management the assistance desired?[134] Only astute management can answer this.

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[131] Lewis. op. cit.

[132] op. cit.

[133] op. cit.

[134] Lewis. op. cit

In this vein, probably the greatest shortcoming of those systems thus designed is that they provide management data, not information.[135] At higher levels of government, how well the computer transforms data to information is of prime importance. Its simulation and forecasting alone can determine its success.

CONGRESS AND PRESIDENT NEED A SYSTEMATIC APPROACH

A vivid example of how a management information system could have served the Congress and the President well surfaced from a visit of a representative of the Office of Management and Budget to Alaska. Senator Stevens (Rep., Alaska) in complaining about PPBS cites the representative's two-day trip around Alaska: "He made a decision as to what was going to close . . . I will bet he doesn't even know that as a consequence of his decision he closed one of the key radar posts in Alaska. This sort of thing is just sheer stupidity."[136]

One official, William D. Carey,[137] a former assistant director of the Bureau of the Budget, said in discussing the deficiencies of the Executive Office of the President that the basic problem is "the lack of a management information system." "The presidency collects only scraps of information about the performance and results of agencies responsible for a thousand different programs. Snowed under by a flood of communications from the departments, the presidency nonetheless is not receiving the right messages," he wrote.

Within the Executive Office of the President lies one of the fine examples of the need for management information systems at very high governmental levels--the Office of Management and Budget. Glines[138] feels that although Director Mayo is doing his best to cope with the

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[135]Ibid.

[136]Glines, C. V. "The Anoymous Bureau of the Budget." Armed Forces Management. March 1970.

[137]Carey, William D. "Presidential Staffing in the Sixties and Seventies." Public Administration Review. September/October 1969. See also same author "Reorganization Plan No. 2: Remarks by William D. Carey." Public Administration Review. November/December 1970.

[138]Glines. op. cit.

extraordinary range of subjects that come within his authority, there is some doubt that his small staff can continue to meet the challenge. The Office of Executive Management requires strengthening; more program evaluation is needed.

Congress recognized a need for a computer-based system in extensive hearings. [139] Schumacher feels that installation of such a management tool for Congress would probably benefit the Congress by promoting more initiation of general policy there as opposed to its being led by the executive branch. Automation offers the Congress an excellent tool; and, most important, this same system would also serve the balance of the government thereby reducing costs. [140, 141] He labels the final stage of this technology application predicative administration at which time high-fidelity information and improved rational techniques permit the prediction of the consequences of decisions almost completely. [142] Real-time processing and high-speed random accessing make this even more true today.

High-level officials often do not receive information in useful form and, therefore, sometimes they seem not even to demand information. An example is the President. He could certainly use more analysis, properly done, to help make better decisions. Substantial policy studies could provide him and his staff leverage against the bureaucracy, indeed, command of particular areas could be most fruitful, exerting control over areas of needed decision-making. A dozen major policy studies per year could be most useful as contrasted to the present innundation of his office by paper. [143]

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[139]"Joint Committee on the Organization of the Congress." 89th Congress, 2d Session, 1966.

[140] Schumacher, B. G. Computer Dynamics in Public Administration. Washington: Spartan Books, 1967.

[141]Wildavsky. "Rescuing Policy Analysis From PPBS." op. cit.

[142]Schumacher. op. cit. p. 5.

[143]Wildavsky. "Rescuing Policy Analysis From PPBS." op. cit.

In mainly speaking of the machinery for grants-in-aid, Ink[144] concludes that we master incredibly complex systems in defense, space exploration, and other physical science activities, but we cannot deliver grants-in-aid rapidly and effectively to state and local governments. The help does not arrive until months--sometimes years-- after it should. And this is only one example of thousands more where a systematic approach can rapidly establish order.

This problem, not really complex in comparison to many in government, lacks a workable approach, yet our systems experts require their systems to be so versatile that a user can ask any question that he can conceive of and that system will accept, interpret, and answer that question.[145] How far we are behind in applications!

Hearle and Mason[146] propose a unified information system for the long-range plans for state and local governments. They feel that these data systems must consider the following:

> Data handling capability is already large and expanding rapidly.

> State and local governments within a state are diverse in organization and function; however, they form a kindred group of public institutions and their interdependencies and interrelationships are increasing.

> These governments employ data for many purposes but their data describe environments of people and property common to many agencies and departments.

Although the thought here is directed to state and local governments, it is much more expansive--the same points hold for all our governments. The unification can proceed on the whole, not just at state and local levels.

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[144]Ink, Dwight A. "A Management Crisis for the New President: People Programs." Public Administration Review. November/ December 1968.

[145]Dion. op. cit.

[146]Hearle, Edward F. R. and Raymond J. Mason. A Data Processing System for State and Local Governments. Englewood Cliffs: Printice-Hall, 1965.

At all higher levels of government, complex decision-making is a routine part of the job of every public official or manager. It is a part of their planning function that objectives or goals are established, plans are developed, programs are established, and a budget is granted. From here it is hoped that feedback information is gathered, analyzed, and adjustments made as needed. No matter how high or how low the level of management, relative to every management function is the decision-making process. [147, 148]

The common characteristics of the decision-making process can be divided as follows:

A compulsion and/or initiation,

Comprehension of the situation,

Consideration of all relevant factors,

Confirmation of the objectives,

Choosing the best solution,

Communicating this choice, and

The consequences of that choice. [149]

All these elements deal directly with information and, except in minor cases, with information flow. [150]

Listing these points emphasizes from a simple approach a daily, routine task required of all decision-makers. On further

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[147]Lewis. op. cit.

[148]See Herbert A. Simon, Donald W. Smithburg, and Victor A. Thompson. Public Administration. New York: Knof, 1950, pages 7-8, for methods used to classify administratively governmental divisions.

[149]Hill, W. Henry and Jack H. Wright. "Concept and Design of Integrated Management Information Systems." Data Processing Yearbook. Detroit: American Data Processing, Inc., 1964. p. 112.

[150]Lewis. op. cit.

reflection, it illustrates just how complex and how much information is required for a logical decision on, for example, SST development.

The point being that for higher levels of government, some systematized approach is the only answer. Even the best management information system thus far projected falls short here. Reflect on the "consideration of all relevant factors" and the SST development question.

One must not be discouraged for giant steps have already been taken. Pennsylvania developed a strategy to form a single organizational entity capable of handling one billion characters of integrated information flow each month. Pennsylvania links 43 interstate agencies to 2630-plus counties, cities, boroughs, and towns and each can transfer information with'n seconds to whatever level of government needs it for decision-making. And the system's activation is on schedule. [151]

In discussion of relevant facts, one must remember not all the decisions are adaptable to the scientific approach. Pure value and normative standards control some decisions. However, these factors may be placed within the structure of a management information system. The limitations are our knowledge and understanding of the factors, not the system. Scientific findings are always subject to normative overrides. Computers properly used can greatly aid in finding the best combinations of scientific fact and normative values in government decision-making. [152]

This does not seem to be one of those cases where what the President and Congress does not know, will not hurt them. It hurts us all.

It has been suggested that better management become a national goal with a national priority and that this goal be integrated with a management information systems approach. [153]

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[151]Long, David A. and John R. Staschiak. "Pennsylvania's Interagency Information System." Sperry Rand Engineering Review. Great Neck, New York, 1970.

[152]Schumacher. op. cit.

[153]Williams, Earnest D. Unpublished paper, April 1971.

LIKELY CHARACTERISTICS OF A GOOD MANAGEMENT
INFORMATION SYSTEM AT HIGHER LEVELS OF GOVERNMENT*

In the works examined, certain characteristics found desirable in systems of similar design and use emerged. It appears beneficial to summarize these as likely and probably worthwhile qualities for management information systems at higher levels of government. These qualities certainly are not encompassing; however, they appear logical.

It is not possible to discuss the characteristics completely in separate categories since they are system qualities; all are interrelated. However, it appears easier to make some separation for discussion purposes.

Planning and Design

Planning and design are clearly the most important phases of a management information system. It is easier to do it right from the beginning than to correct it later.

The following characteristics, somewhat in their order of importance, abounded in the work searched. Here, more than in any of the following phases of the task, these characteristics are important because they form the basis and so many of the later interfaces that determine the success or failure of the undertaking.

A. The undertaking must have the support of the manager or official who directs the organization. He must want, understand, and plan to use the system and must instill this sense of value in all the organization below him. This may well be the most important aspect of any management system.

B. The system must be user-oriented. Planning and all phases thereafter have only one purpose--service to the using manager to aid in decision-making. This includes a full determination of the manager's needs as related to the objectives of his office, a study of the environment in which the system and the manager must function with internal and external organizational structures defined, and determination of priorities of lower level users serving the top manager.

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*This is a summary of qualities and the references used are acknowledged in Appendix III.

C. Education must begin at once to the extent necessary at all levels of the organization. An education plan should be developed beginning with the top manager and extending to all personnel in the organization. Of course, for some personnel far from the system, education consists of a memorandum from the manager explaining what the objectives of the system are and ending with his full endorsement of the undertaking. This education program insures cooperation, reduces the friction and upheaval of change, makes personnel changes easier, enlists the task-force approach of everyone's making a contribution and insures that everyone is ready to implement the system when it is ready. Critical path management methods are most appropriate here.

D. The entire undertaking must be systematic in terms of objectives. Haste still creates waste.

E. The requirement that computing equipment already owned must be used in so far as possible for the new management information system must not become a handicap. The technical capability exists to design a fine system in spite of this handicap; however, planning and design must incorporate updating capability.

F. The latest capability for systems analysis including predictive methodology must be incorporated. Much of the value of the system rests solely on its ability to perform simulation, do prediction, and correlate all models with all other models where a relationship exists. The system must incorporate as a part of this analysis accounting data clearly giving accounting parameters to the extent necessary to enable end-result analysis.

G. The electronic data processing equipment should:

1. Be fully human engineered.

2. Involve the best, silent output devices requiring the least amount of physical function on the part of the user. This is emphasized in addition to human engineering. Buy this equipment new if the best is not already owned.

3. Incorporate inherent capability to determine its own optimum processing cycles.

4. Possess generality and flexibility.

5. Standardize in all possible parameters.

43

6. Integrate fully with all sub-systems.

7. Insure high-fidelity, error-free data to the extent possible (internal checks).

8. Provide maximum consolidation of data.

9. Not interface with any personnel except at the input terminals (require no human action to solve any user problem such as placing additional tapes on readers).

The Implementation of the System Into
The Organization

As already noted, this phase began early in initial planning. Implementation usually requires additional effort on everyone's part since duplication of the previous ways of doing business must be retained until the newer ways prove themselves operational. This additional effort probably coincides with the time of greatest change in the organization. Extra attention to personnel factors greatly insures smoother transition.

Use and Outputs of the System

Again some things which began in planning must be emphasized here as long as the system remains viable.

The user-oriented parameter always remains prime. Give the user the information in the form and at the time it is desired. Artificial deadlines and "once-a-weeks, need it or not" are out.

The outputs must always remain goal-oriented with measurements of progress against planned performance. Out-of-line conditions must be easily reported.

Even though education began early, it must continue. The user and his organization must simply have, keep, and use a systems

analysis viewpoint. All must search with dedication for a clearly preferable* alternative in decision-making. Any relaxation on the part of the user wastes the capability of the system and misses the objective altogether. Qualified personnel remain scarce and in-house education may determine success or failure.

Systems analysis may not help determine in many cases the rank of health and defense in the national priorities; but, it will enable better use of all available resources and, thereby, give a higher grand total output. In this vain--a few studies well done produce more than many poorly done. Mindless quantification merely muddles decision-making and make-work drives away analysis.

Test and Evaluation of the System

Test and evaluation of the system begin in earnest at its first use. Test and evaluation are of two types: the user test and evaluation and test and evaluation of the non-human portions of the system.

The using manager and his organization must perform the test and evaluation of the system's output. The brightest people in the whole organization should be involved in this system and all should be keenly attuned to suggestions toward improvement.

Methods are being developed to allow testing and evaluation of the non-human portions of the system especially to determine its overall efficiency. These offer considerable savings in money on massive systems, therefore, they are a part of the systems approach.

CONCLUSIONS

From the standpoint of technology, there are no major hitches left in building useful management information systems for all higher

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*Recognition here of value and normative factors in decision-making at higher levels of government leads to the term preferable solution as opposed to optimal solution. This also recognizes in the term the existence of primary and secondary goals in decision-making and, at times, the impossibility of determining which are primary and which are secondary.

levels of government. The electronic data processing equipment technology exceeds the requirements. Systems analysis, although probably never exhausted, is certainly so great an aid in decision-making that it is desirable to employ it as early as possible. The data base is weak. This shortcoming could be corrected in about five to seven years and is being improved greatly even without the emphasis higher systems requirements would give.

The recognition of the possibilities of improvements via management information systems does not appear fully accepted at many places in our government. This is improving rapidly.

Research in advanced computer techniques insures the availability of capability and methodology when the Congress and the President elect to begin implementation. [154]

It is my opinion that the first major system will appear in the Executive Office of the President about 1980. This could be greatly hastened by direction from the President.

Further confirmation that management information systems are indeed ready for service at the highest levels of government came unexpectedly.

The USSR appears to be building such a system now. [155] The Soviets seem to have embarked on a plan to triple their computer capability within the next five years. The first step began by approving a national network of computerized data banks to take over the management of many sections of the economy from the human planner. The party congress with Secretary-General Brezhnev as a leading supporter approved "an automated nationwide system for the collection and processing of information essential for the control, the planning and the management of the country's economy, based on the state network of computer centers and on the unified automatic communications system for the country as a whole."

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[154] For further examples of this sort of research, see "Resource Sharing Computer Networks," Spring Joint Computer Conference, L. G. Roberts, ch., Atlantic City, May 7, 1970, sponsored by the Advanced Research Projects Agency, Washington, D. C.

[155] Zorza, Victor. "Visions of 1984: Soviets Plan Computer Complex." The Huntsville Times. Huntsville, Alabama, Monday, July 26, 1971.

Professor Viktor Gluskov, Director, Kiev Cybernetics Institute, hailed the decision as an endorsement of his idea to "set up a unified nationwide automated management system" and "of attacking this complex problem in an organized manner."

Gluskov feels that what must be designed and built "is not simply the technical means for the processing of the data, not simply electronic calculators, but an integrated system of management--a machinery with the mathematical software, with economic and social criteria, with a structure of the functions, the obligations, and the responsibilities of the leaders--indeed, a whole system."

He predicts the system by 1980.

At this point, it seems well to remember that computers and analysis are neutral--they just assist, no matter the goals.

President Roosevelt[156] once warned: "Eternal truths will be neither true nor eternal unless they have fresh meaning for every new social situation."

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[156]Roosevelt, Franklin D. Address, University of Pennsylvania, September 20, 1940.

APPENDIX I
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APPENDIX II
A SAMPLING OF MILITARY AND OTHER GOVERNMENT
MANAGEMENT INFORMATION SYSTEMS

This list is compiled as an example of military and other government work in management information systems. The list is not exhaustive. The numbers are ordering information from the Clearinghouse for Federal Scientific & Technical Information, Springfield, Virginia 22151.

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52

APPENDIX III
REFERENCES FOR LIKELY CHARACTERISTICS OF A GOOD
MANAGEMENT INFORMATION SYSTEMS AT HIGHER
LEVELS OF GOVERNMENT

Anthony. op. cit.

Archibald et al. op. cit.

Blomgren. op. cit.

Bowman. op. cit.

Carney. op. cit.

Carter. op. cit.

Chapman. op. cit.

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Dion. op. cit.

Dror. op. cit.

Field. op. cit.

Gosden et al. op. cit.

Halstead. op. cit.

Hearle et al. op. cit.

Ink. op. cit.

Kessler. op. cit.

Kriebel. op. cit.

Lang et al. op. cit.

Levin. op. cit.

Lowe. op. cit.

Mahoney. op. cit.

Schrader. op. cit.

Schroder. op. cit.

Schroeder. op. cit.

Schumacher. op. cit.

Spiegal et al. op. cit.

Wildavsky. "Rescuing Policy Analysis from PPBS." op. cit.

Wilkins. op. cit.

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13. ABSTRACT

This is a time in our Nation of great social change and unrest. Our government continues to move ahead with reforms, but, at times, these reforms seem slow in bringing about needed improvements. Many of these problems are wholly or partly managerial in nature.

A partial solution to many of these problems would be found in the use of management information systems by higher levels of government--the Congress and the President.

Consideration is given to more extensive use of modern management approaches and tools, especially systematic approaches using management information systems, to assist public officials and managers in conducting better policy analyses, in determing more overtly the priorities of government, and in evaluating these efforts in a more efficient manner.

A literature evaluation leads to a compilation of the most desirable characteristics of management information systems at higher levels of government.

It is predicted that a management information system will be installed in the Executive Office of the President about 1980. This prediction compares well with apparent Soviet accomplishments in using computers for management purposes.

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14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
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Electronic data processing						
Management information systems						
Automatic data processing						
Decision-making						
Data						
Data bare						
Social change						
Systems analysis						
Systems management						
Systems approaches						
Operations research						
Executive Office of the President						
Congress						